

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
5 April 2001 (05.04.2001)

PCT

(10) International Publication Number
WO 01/23926 A1

(51) International Patent Classification⁷: **G02B 6/22, 6/20**

(21) International Application Number: **PCT/AU00/00919**

(22) International Filing Date: **2 August 2000 (02.08.2000)**

(25) Filing Language: **English**

(26) Publication Language: **English**

(30) Priority Data:
PQ 3207 **30 September 1999 (30.09.1999) AU**

(71) Applicants (for all designated States except US): **THE UNIVERSITY OF SYDNEY [AU/AU]; Parramatta Road, Sydney, NSW 2006 (AU). THE AUSTRALIAN NATIONAL UNIVERSITY [AU/AU]; Acton, ACT 0200 (AU). AUSTRALIAN PHOTONICS PTY LTD [AU/AU]; 101 National Invention Centre, Australian Technology Park, Eveleigh, NSW 1430 (AU). KOREA TELECOM RESEARCH AND DEVELOPMENT GROUP [KR/KR]; 17 Woonyeon-dong, Sucho-ku, Seoul (KR).**

BAILEY, Ronald [AU/AU]; 6 Brent Close, Watanobbi, NSW 2259 (AU). FLEMING, Simon [AU/AU]; 46 Henry Street, Ashfield, NSW 2131 (AU). SEATS, Mark [AU/AU]; 74 Lamb Street, Lilyfield, NSW 2040 (AU). THORNCRAFT, David [AU/AU]; 10 Bainton Crescent, Melba, ACT 2615 (AU). KRUG, Peter [AU/AU]; 26 McClelland Street, Willoughby, NSW 2068 (AU). POLADIAN, Leon [AU/AU]; 4/1 Charlton Way, Glebe, NSW 2037 (AU). LARGE, Michael [AU/AU]; 25A Congham Road, West Pymble, NSW 2073 (AU). RYAN, Thomas [AU/AU]; 66/65 Myrtle Street, Chippendale, NSW 2008 (AU).

(74) Agent: **GRIFFITH HACK; GPO Box 4164, Sydney, NSW 2001 (AU).**

(81) Designated States (national): **AU, CA, JP, KR, US.**

(84) Designated States (regional): **European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).**

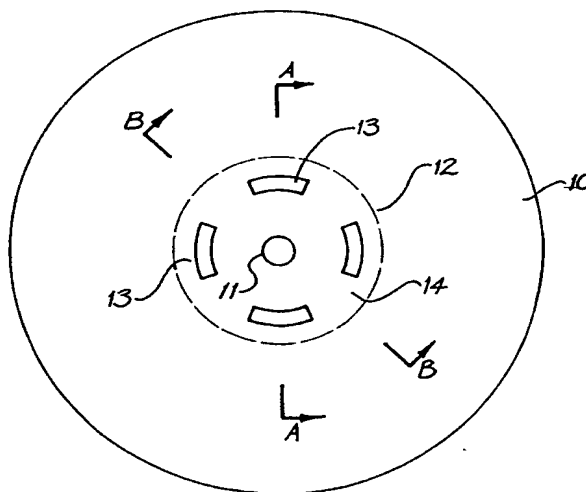
Published:
— *With international search report.*

(72) Inventors; and

(75) Inventors/Applicants (for US only): **LOVE, John [AU/AU]; 55 Barber Crescent, Flynn, ACT 2615 (AU).**

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: **SINGLE MODE OPTICAL WAVEGUIDE FIBRE**



(57) Abstract: A single mode optical waveguide fibre is disclosed which preferably is formed to exhibit low but non-zero dispersion at a wavelength λ in the order of 1550 nm. The fibre has a light guiding region that includes a central core region (11), a core-surrounding region (14) and at least three angularly separated side core regions (13) that are disposed radially outwardly from the central core region. The central core region (11) has an average refractive index n_0 , the surrounding region (14) has an average refractive index $n_1 < n_0$, and each of the angularly separated regions (13) have an average refractive index $n_2 \neq n_1$.

WO 01/23926 A1

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU00/00919

A. CLASSIFICATION OF SUBJECT MATTER												
Int. Cl. ⁷ : G02B 6/22, 6/20												
According to International Patent Classification (IPC) or to both national classification and IPC												
B. FIELDS SEARCHED												
Minimum documentation searched (classification system followed by classification symbols)												
Int. Cl. ⁷ : G02B 6/16, 6/17, 6/18, 6/20, 6/22												
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched												
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) DWPI, JPAT, IFIPAT: side(W) core?, plural+ (3W) core?, multi+ (W) core?, side?core?, multi?core?, hole?, channel?, void?, fibre?, fiber?, photonic (W) crystal?, angular+, dispers+, vacuum												
C. DOCUMENTS CONSIDERED TO BE RELEVANT												
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.										
X	WO 99/00685 A (THE SECRETARY OF STATE FOR DEFENCE) 7 January 1999 Whole document	1-8,11-12,14-17										
X	US 5802236 A (DIGIOVANNI et al.) 1 September 1998 Whole document	1-8,11-12,14-17										
X	US 5734773 A (TESHIMA et al.) 31 March 1998 Whole document	1-8,11-12,14-17										
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C <input checked="" type="checkbox"/> See patent family annex												
<p>* Special categories of cited documents:</p> <table border="0"> <tr> <td>"A" document defining the general state of the art which is not considered to be of particular relevance</td> <td>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</td> </tr> <tr> <td>"E" earlier application or patent but published on or after the international filing date</td> <td>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</td> </tr> <tr> <td>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</td> <td>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</td> </tr> <tr> <td>"O" document referring to an oral disclosure, use, exhibition or other means</td> <td>"&" document member of the same patent family</td> </tr> <tr> <td>"P" document published prior to the international filing date but later than the priority date claimed</td> <td></td> </tr> </table>			"A" document defining the general state of the art which is not considered to be of particular relevance	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention	"E" earlier application or patent but published on or after the international filing date	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone	"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art	"O" document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family	"P" document published prior to the international filing date but later than the priority date claimed	
"A" document defining the general state of the art which is not considered to be of particular relevance	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention											
"E" earlier application or patent but published on or after the international filing date	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone											
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art											
"O" document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family											
"P" document published prior to the international filing date but later than the priority date claimed												
Date of the actual completion of the international search 24 October 2000		Date of mailing of the international search report - 2 NOV 2000										
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustalia.gov.au Facsimile No. (02) 6285 3929		Authorized officer RAJEEV DESHMUKH Telephone No : (02) 6283 2145										

INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU00/00919

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	Derwent Abstract Accession No. 94-037528/05, Class V07, JP 5-341147 A (ASAHI CHEM IND CO LTD) 24 December 1993 Abstract; drawing	1-8,11-12,14-17
X	US 4913521 A (TAJIMA et al.) 3 April 1990 Whole document	1-8,11-12,14-17

INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU00/00919

Box I Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos :
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☒ Claims Nos : 18
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
Claim 18 does not comply with PCT Rule 6.2(a).

3. ☐ Claims Nos :
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a)

Box II Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/AU00/00919

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report				Patent Family Member			
WO	9900685	AU	81169/98	EP	991967	GB	2341457
US	5802236	EP	810453	JP	10095628		
US	5734773	WO	9532442	EP	802432		
JP	5341147	NONE					
US	4913521	JP	1237507	EP	319319		
END OF ANNEX							